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Fluctuation-induced force mediated by turbulent fluctuations

MAHDI DAVOODIANIDALIK, HORST PUNZMANN, The Australian National University, HAMID KELLAY, Universit de Bordeaux, HUA XIA, NICOLAS FRANCOIS, MICHAEL SHATS, The Australian National University — Understanding hydrodynamic interaction forces between large particles aggregates or objects is important in a range of problems encountered in industrial and natural flows. Here we report a long-range attraction force mediated by turbulent fluctuations between two large anisotropic objects, beam, exposed to the wave-driven turbulence. In this system, we show that the magnitude of the force is a function of two parameters: the beam separation and the energy injection rate. A model is proposed that describes how this attraction force depends on the change of energy and structure of the confined turbulent flow. The physical mechanism responsible for this attraction force is related to the nontrivial coupling of the Lagrangian structure of the flow with the cavity formed by the beams. These results provide valuable insights in force generation mediated by turbulent fluctuations and in the recent discovery of turbulence-driven propulsion.

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